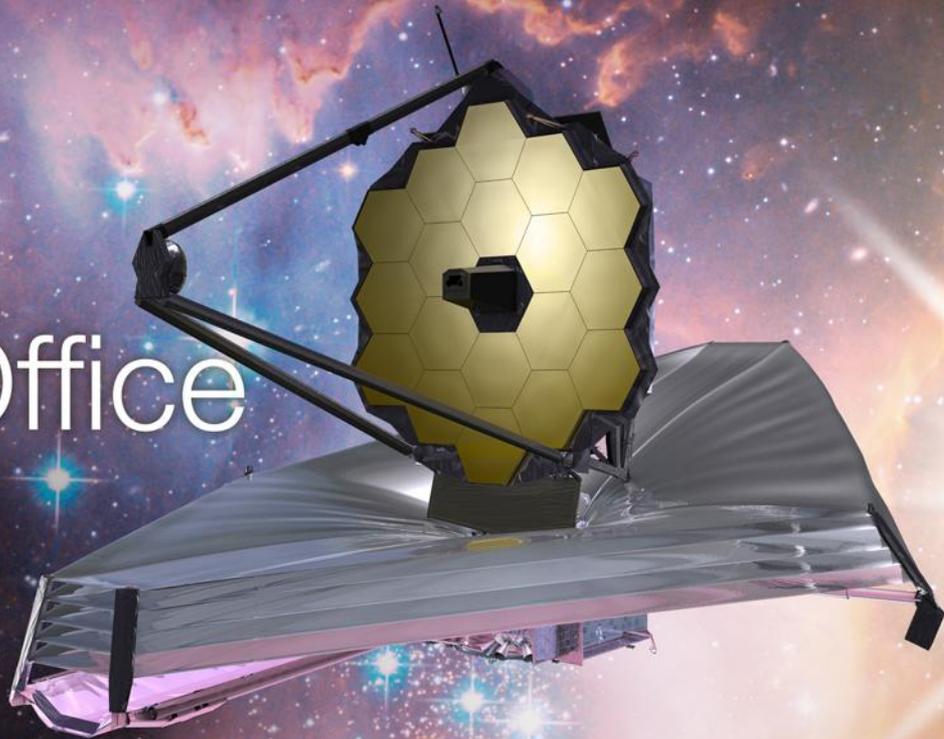




JWST Program Office



Geoff Yoder
JWST Program Director

Astrophysics Subcommittee
July 30, 2012

Implementing the New Baseline

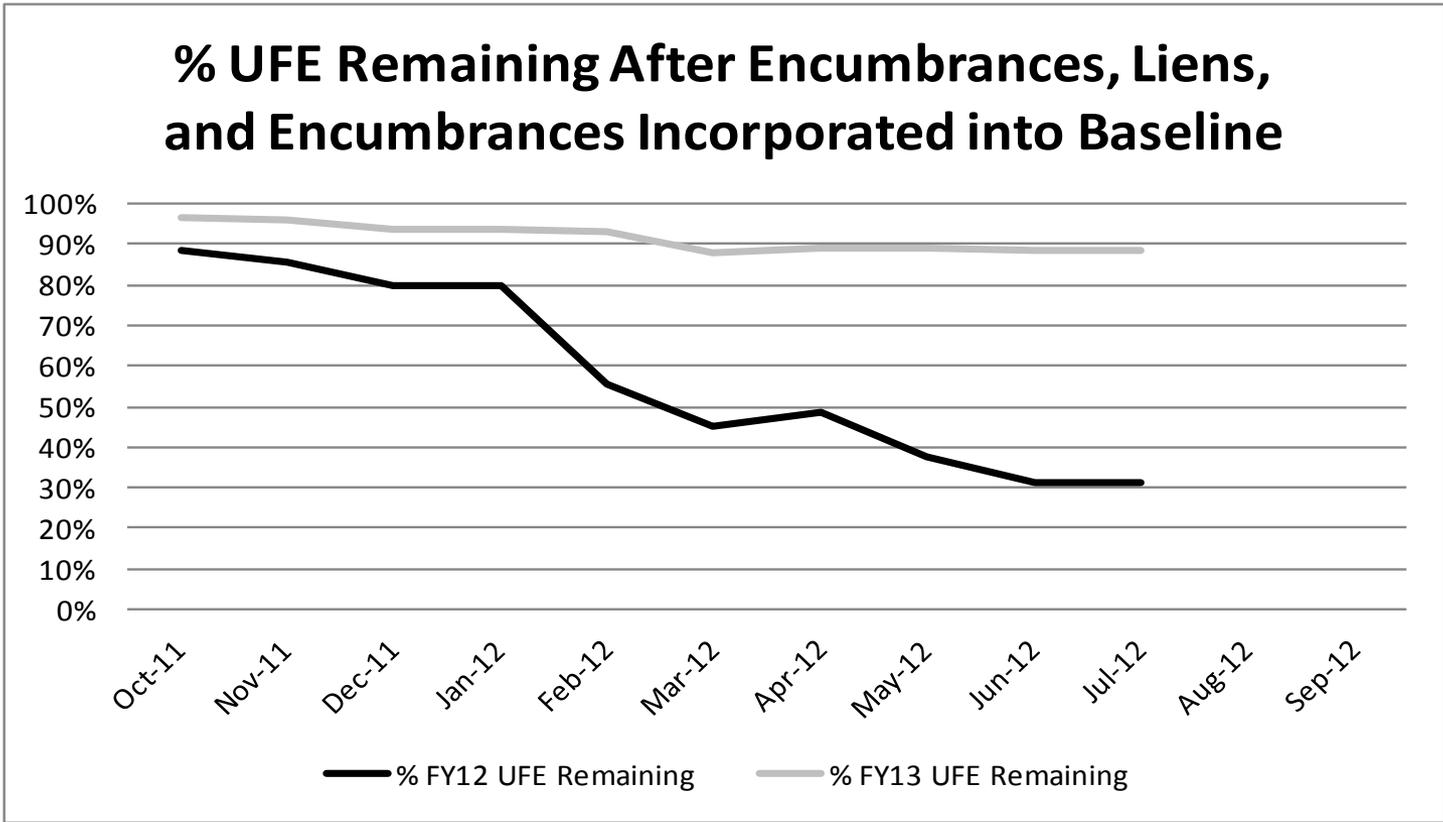
- Completed the replan (9/23/2011) with an October 2018 launch date
 - Plan has adequate cost and schedule reserves consistent with ICRP recommendation
 - Additional \$44M in FY11 was approved by Congress
 - FY12 budget approved by Congress with full funding for JWST
 - FY13 PBR fully funds the new baseline
- Recent Accomplishments
 - All flight optics have been cryo tested and meet requirements
 - Completed the Aft Optic System integration and alignment and cryo testing
 - Primary Mirror Backplane Support Structure center section is complete, wings being assembled
 - Sunshield full scale Engineering Development Unit for layers #3, #5, testing completed with good results
 - Instrument deliveries to GSFC have started (MIRI – May 29, 2012), FGS (next week!), NIRCcam Fall 2012, NIRSspec (April 2013)
- Brought back in work with additional FY11 funding and FY12 budget
 - Accelerated: Backplane Support Frame (BSF) by 4 months, completion of PMBSS by 4 months, start of Wings by 18 months, end of Flight Optics Integration by 4 months
 - Now have 14 months of funded schedule reserve on critical path (approved Baseline in 9/2011 had 13 months)
- Instrument deliveries slipped moving ISIM delivery to OTIS by 5 months (31 months to 26 months)
 - After detector change out and addition of cryo-vac test #3, still have 9 months slack for ISIM delivery to OTIS
 - ETUs for NIRSspec and NIRCcam may be used in ISIM Cryo Test 1 (all have flight hardware for CT 2+3)

JWST made great progress in FY11 and continues to do so in FY12, achieving milestones within cost and schedule and executing to the new baseline

Budget and UFE

Current (FY 13 Budget, FY 14 G/L) Life-Cycle Cost Estimate by Year and Phase (Includes Program/MD-held UFE, Indirect, Labor, and CoF)

	Prior	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	CTC	TOTAL
Total	3,528.9	530.6	627.6	659.1	646.6	621.6	571.1	536.9	305.0	197.5	610.0	8,835.0
Pre-Formulation and Formulation	1,800.1	-	-	-	-	-	-	-	-	-	-	1,800.1
Development	1,728.8	530.6	627.6	659.1	646.6	621.6	571.1	536.9	228.0	47.5	-	6,197.9
Operations	-	-	-	-	-	-	-	-	77.0	150.0	610.0	837.0



Encumbrances items incorporated into baseline mainly in three areas:

- ISIM/NIRCam, Replacement Detector procurement, and MIRI cycocooler

Focus Areas with our Stable Cost and Schedule Baseline

- Execution: Do what we said we are going to do – and where possible, better
- Communication: Maintain and increase open communications with NASA senior management, partners, customers and stakeholders
- Education: Highlighting the tremendous science returns we will achieve from JWST

Execution

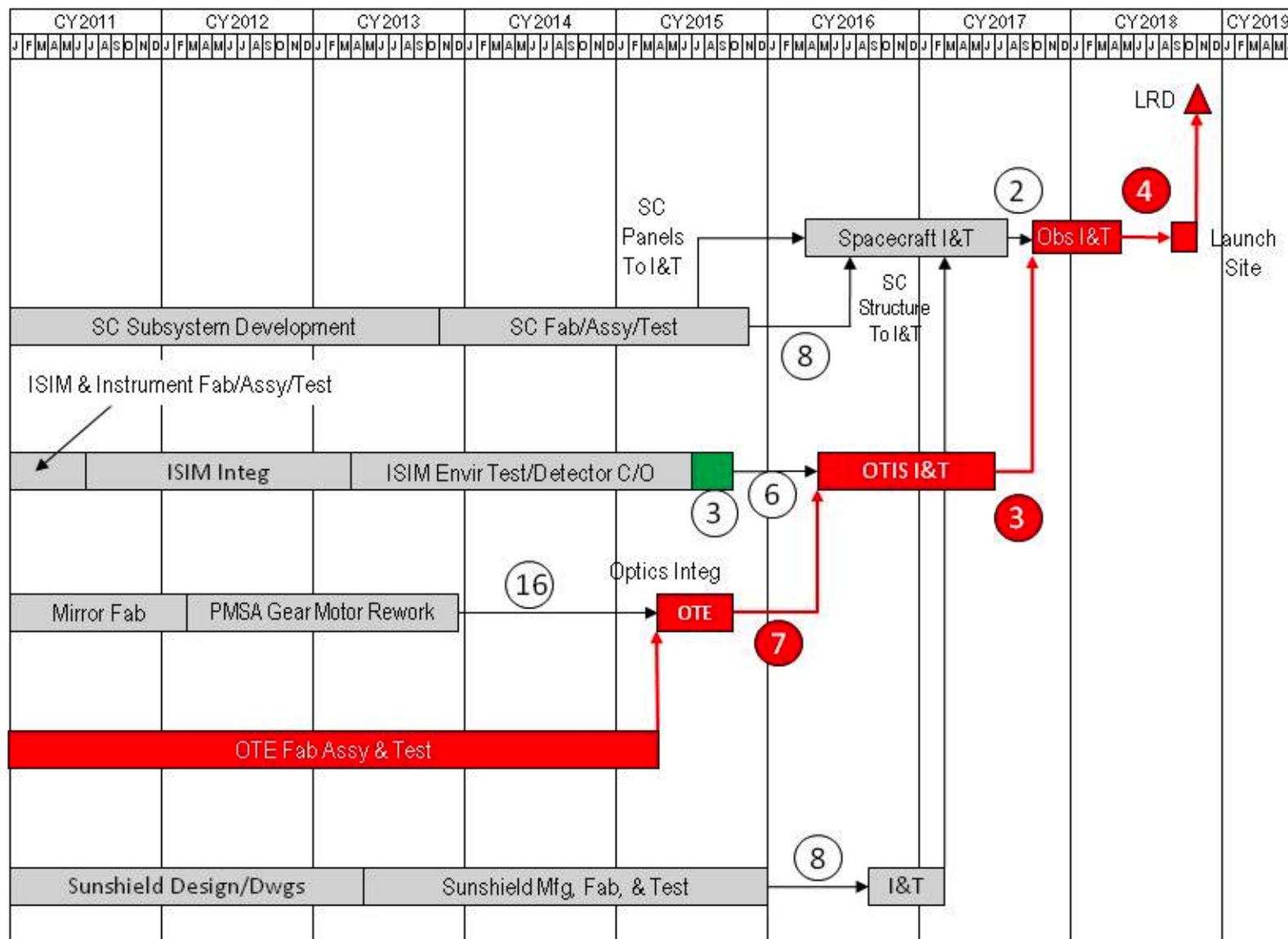
- Focus on all paths not losing sight of competing and critical path items
- High Level Watch Points
 - ISIM Cryo-vacuum Tests 1-3 (2013-2014)
 - Instrument deliveries
 - Objectives of each test
 - Ensure test plans have flexibility for inevitable I&T occurrences
 - Mass Margins
 - Verify and monitor time phased burn down plan
 - Overall schedule margin and competing critical paths
 - Workforce focus
 - Balanced staffing and messaging

Summary from the Office of Evaluation Progress Assessment Conducted May 30, 2012

– Review Overview

- “The JWST P/p team and oversight organizations provided thorough and informative briefings to the panel at NASA-HQ May 30, 2012. The JWST project overall is operating within the white lines of the rebaseline of September 2011. The panel noted that the project continues to make good technical progress while preserving the level of schedule reserve on the critical path and performing to the rebaseline budget including UFE.
 - Technical: **Green**
 - Cost/Budget: **Green**
 - Schedule: **Green with concern** that the ISIM cryovac testing sequence and strategy are not yet fully understood nor are the risks associated with the detector change-out and the instruments yet to be delivered. (See Major Changes regarding ISIM below.)”

JWST Schedule (as of May 2012)



Recent Instrument Progress



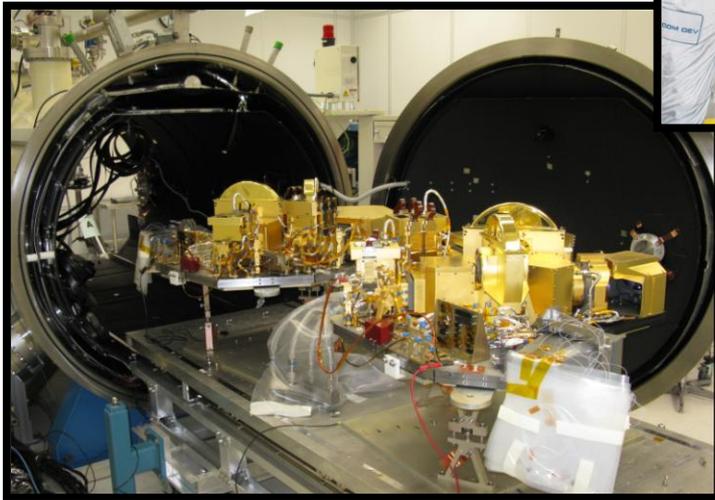
MIRI now at GSFC

FGS/NIRISS completing its CV testing



Instrument and ISIM integration & test is underway

NIRSpec instrument being reassembled

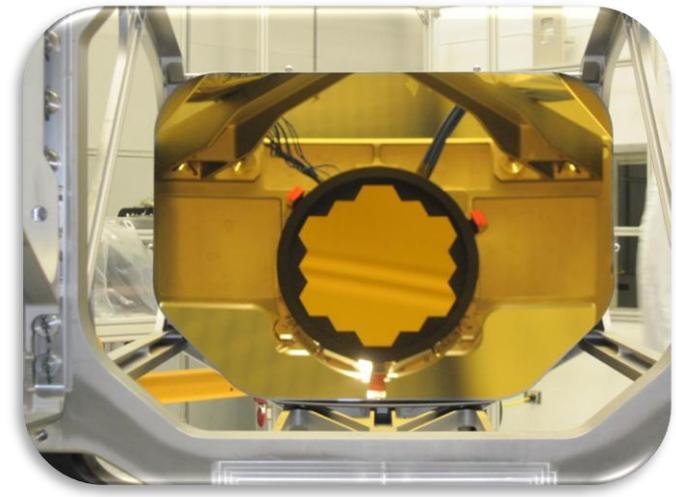
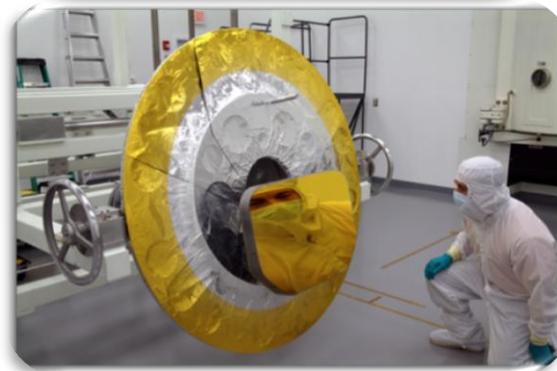
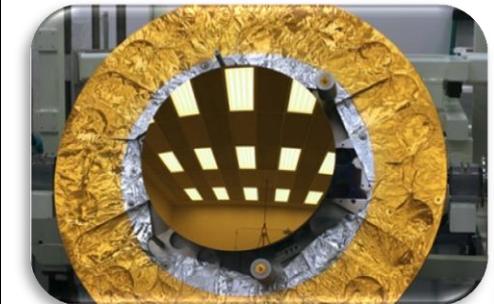


NIRCam A & B modules at LM test facility



Optics

- All mirror are Complete!
- Aft Optics Assembly (AOS) integration and testing complete
- Primary Mirror segments undergoing gear motor replace and repair, 2 segments and secondary completed, another segment in process
- Flight Cryo Electronics on track for incremental deliveries over the next year



Buildup of Telescope Flight Structure

Completed Primary Mirror Backplane Support Structure (PMBSS)



Primary backplane elements making great progress on an accelerated schedule

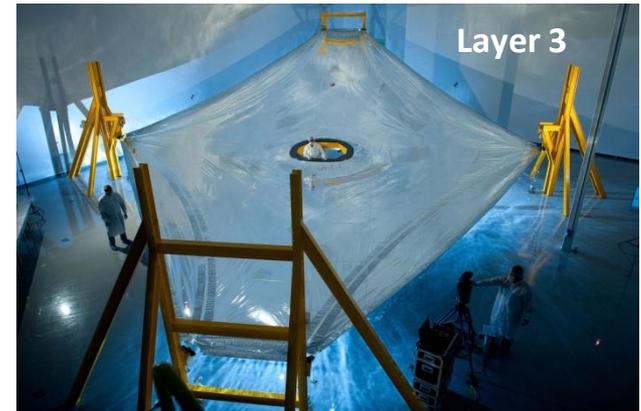
Primary Mirror Wings Being Assembled



Sunshield Template Membrane Work On-Going

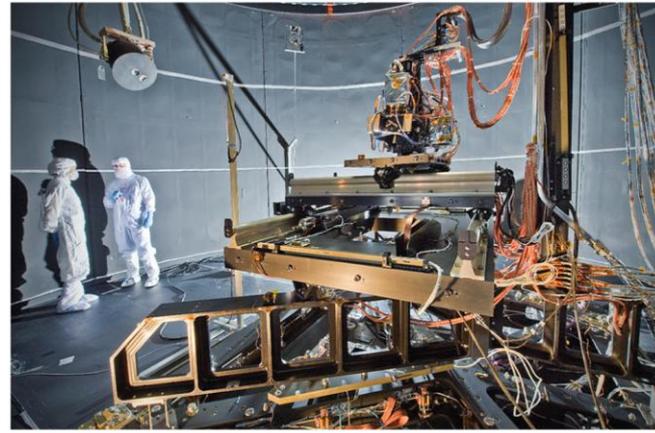
Templates Verify Design Prior to Flight Build

- Template Layer 3 testing completed
 - All shape measurement data good
 - Delivered in place to NGAS
 - Layer 3 hole punching successfully completed
- Template Layer 5 – shape testing completed
 - All shape measurement data good
- Template Layer 4
 - Manufacturing and testing is complete , data analysis in progress
- Template Layer 2
 - In manufacturing

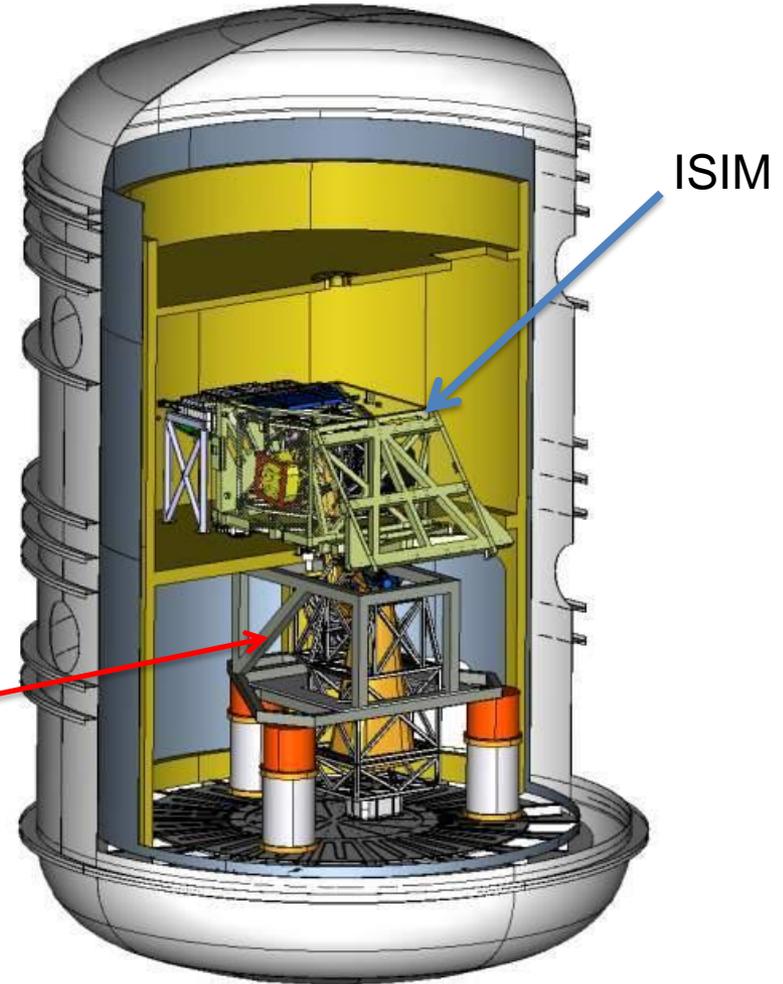


Optical telescope element Simulator (OSIM) Integration

Beam Image Analyzer atop the OSIM



OSIM and ISIM in Space Environment
Simulator Chamber at GSFC



OSIM in SES Chamber (OSIM cert. test 1 completed)



Modified Chamber A Systems

COMPLETED INSTALLATION

Nitrogen Distribution System

Helium Distribution System

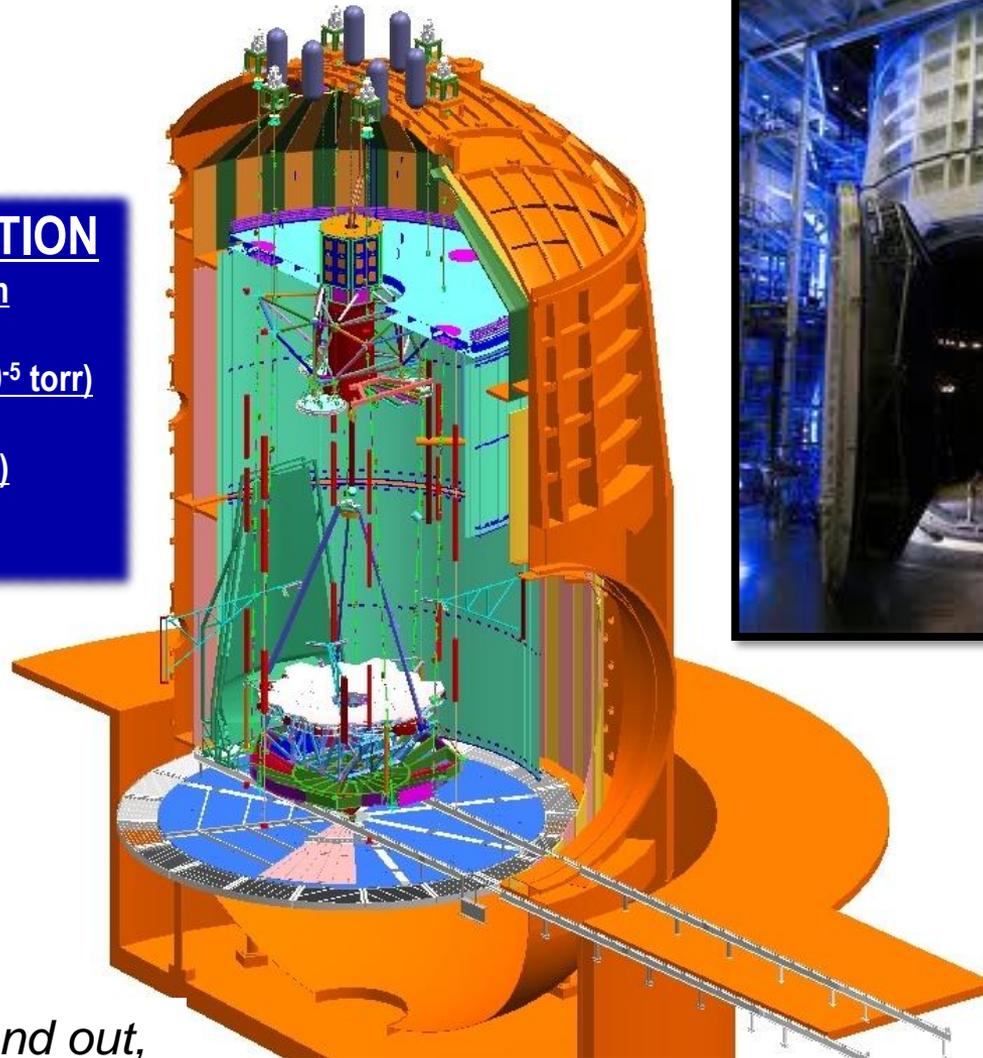
High Vacuum System (10^{-4} to $\leq 10^{-5}$ torr)

Helium Shroud (20 to 333K)

Nitrogen Shroud (90 to 385K)

Radiant Barriers

Rail System

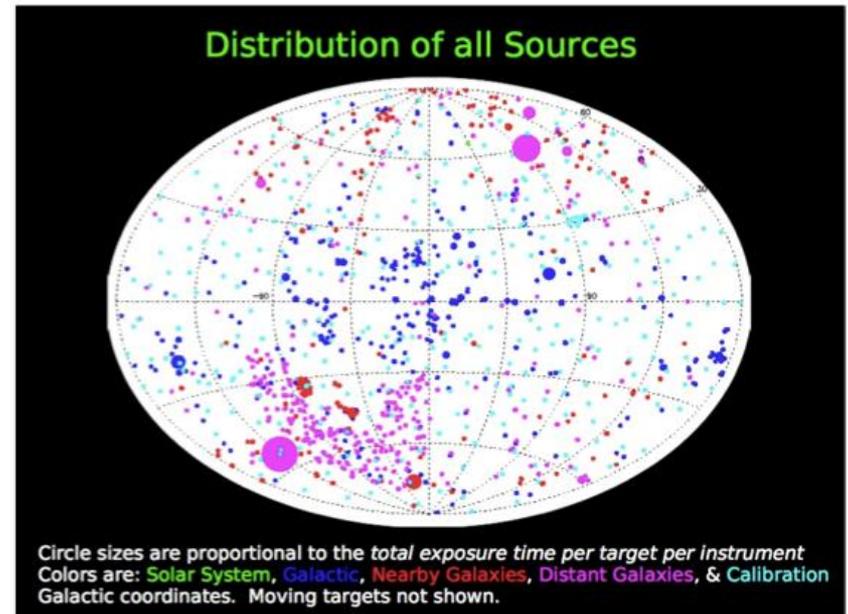


*New equipment, inside and out,
to meet strict requirements for
temperature and cleanliness*

STScI Progress

- On-board scripts for ISIM Cryo #1 are being certified in high fidelity lab at GSFC.
 - Scripts will command NIRCcam, MIRI and FGS operations during Cryo #1, exercising 27 (out of a possible 54) script functions.
 - Certification planned to be completed in Dec. 2012.
- Science instrument staff are participating around the clock in NIRCcam cryo test.
- First prototype version of NIRCcam data pipeline on track for completion in September.

- Nearing completion of update to the Science Operations Design Reference Mission (SODRM) – a realistic observing program spanning 1.6 years. The SODRM enables studies of observatory observations, data volume, observing efficiency, mechanism usage and momentum management.



*The Distribution of Sources
on the Sky from the SODRM*

- How to best leverage their scientific and instrument expertise during the upcoming I&T phases
 - Near real time science assessment of test results and implications for ultimate performance will be needed
- 5-pager top level science for educators/laypersons
- SWG activity planning during next 4 years

James Webb Space Telescope Program FY12 Milestones

Month	Milestone	Comments
Oct '11	Begin construction of 140,000-lb robotic facility to build segmented main mirror at GSFC	Assembly began 10/4
Nov '11	Complete electronics simulator model for Integrated Science Instrument Module ("ISIM") Deliver tools for software development environment and verification	Completed 11/15 Completed 10/27
Dec '11	Install Helium shroud floor at Johnson Space Center thermal vacuum chamber ("JSC TVC") Determine root cause of NIRSpec optical bench flaw	Completed 10/26 Completed 12/15
Jan '12	Conduct Critical Design Review for Spacecraft-to-Optical Telescope Element vibration isolation system Finish building Center of Curvature Optical Assembly ("COCOA") for testing primary mirror in JSC TVC Review preliminary requirements for ground structure for spacecraft equipment panels Complete Aft Optic System integration and alignment Update Program Plan and Program Commitment Agreement to reflect replan	Completed 12/15 Completed 1/13 Completed 12/1 Completed 12/2 Completed 1/28
Feb '12	Complete assembly and initial testing of main mirrors at Marshall Space Flight Center Install Helium shroud walls at JSC TVC	Completed 12/19 Completed all panels 2/2
Mar '12	Complete assessment of System Engineering Team thermal margins Deliver ISIM computer #2 to ISIM integration and testing Complete analysis of JSC TVC telescope testing equipment plans	Completed 3/1 SDRAM part failure in T/V. Completed 5/16 Completed 3/19

James Webb Space Telescope Program FY12 Milestones

Apr '12	<p>Receive Flight Mid-infrared Instrument (MIRI) from Europe, first of the telescope's four science instruments</p> <p>Complete Critical Design Review for Sunshield Support Structure</p> <p>Complete all composite parts for mechanism that lifts telescope away from spacecraft after launch (Deployable Tower Assembly)</p>	<p>Received 5/29</p> <p>Completed 3/21</p> <p>Completed 2/28</p>
May '12	<p>Finish testing the COCOA</p> <p>Measure Sunshield template layer 5 shape to confirm its accuracy</p> <p>Conduct budgetary and schedule review of initial program and project performance since completing the 2011 replan</p>	<p>Completed 3/9</p> <p>Completed 4/23</p> <p>Completed 5/30</p>
Jun '12	<p>Complete modifications of JSC TVC</p> <p>Complete Critical Design Review for telescope-ground communications system</p> <p>Complete designs for structures that will hold telescope inside JSC TVC</p> <p>Complete Preliminary Design Review for equipment that tests Sunshield deployment</p>	<p>Completed 6/30</p> <p>Completed 6/13</p> <p>Completed 6/21</p> <p>Completed 6/28</p>
Jul '12	<p>Reach agreement with Program Office on FY13 spending plan</p> <p>Deliver Flight Fine Guidance Sensor</p> <p>Deliver flight software to ISIM Integration and Testing ("ISIM I & T")</p> <p>Complete Solar array Preliminary Design Audit</p> <p>Deliver MIRI Cryo Cooler "Cold Head Assembly" (critical component of MIRI cooling) to ISIM I&T</p> <p>Complete fabrication of end fitting for Secondary Mirror Support Structure</p>	<p>Flight CHA to be delivered in June 2013. No schedule, impact, work around in place.</p>
Aug '12	<p>Order remaining JSC thermal vacuum chamber vibration isolators</p>	
Sep '12	<p>Deliver NIRCcam</p> <p>Deliver telescope simulator for ISIM I&T</p> <p>Start testing of cryogenic camera system, used for subsequent JSC I & T</p> <p>Complete center section of Backplane Support Structure for main mirror</p> <p>Deliver NIRSspec</p>	<p>Moved to 11/2012, work around in place</p> <p>Completed 3/28</p> <p>Delivery date 4/2013.</p>

James Webb Space Telescope Program FY12 Milestones

SDRAM Part Failure in Thermal Vacuum Testing

- ISIM Computer #2 experienced a single synchronous dynamic random access memory chip failure during computer thermal vacuum testing. Chip was replaced, computer retested and accepted into ISIM integration and test.

MIRI Delivery Delay from 4/29/12 ship date to arrival at GSFC on 5/29/12

- Additional vibe required prior to Acceptance Board and shipment
 - Kinematic strut workmanship verification
 - Legs supporting optical bench see highest stresses in leg-end fitting joints at cryo conditions.
 - Post-vibration alignment anomaly
 - An alignment off-set was measured after original vibration test, which has not yet been explained. The off-set disappeared after cryo test.

MIRI Cryo Cooler Cold Head Assembly

- Solenoid Cryo-Valves in the MIRI Cooler Cold Head Assembly are not meeting the leak rate requirement
 - Determination of root cause and evaluation of alternate paths will not support a flight configured CHA delivery in July 2012
- A non-flight configuration will be used to support Cryo Vac Test #1 in early 2013
 - Baselined Cryo Vac Test #3 (included in replan) still maintaining minimum 2 cryo vac tests/flight instrument
- New June 2013 date supports integration into ISIM before the vibe testing that precedes Cryo Vac Test #2

NIRCam delivery to Integration and Test delayed till 11/2012

- Drivers included:
 - Electronics aliveness/functional testing
 - Took weeks instead of days
 - » Anomaly resolution, harness repairs, etc. (In general getting the system operational as an instrument)
 - Instrument Control Electronics board difficulties
 - Getting boards through testing, anomaly resolution, board repairs
 - Focal Plane Electronics grounding issue

NIRSpec Instrument Delivery

- Cracks were discovered on the Optical Bench while performing final inspections
 - Cracks could affect the structural integrity of the bench, leading to structural failure
- Decision made to use flight spare bench
 - De-integrate current bench, re-qualify flight spare bench, re-integrate instrument, repeat environmental testing
- New delivery date 4/2013
 - No impact to Cryo Vac Test #1 (will use NIRSpec Engineering Test Unit already at GSFC)
 - Baselined Cryo Vac Test #3 (included in replan) still maintaining minimum 2 cryo vac tests/flight instrument

Challenges ahead as we enter critical I&T phases

JWST team continues to execute to our LRD commitments



Backup

Stop Light History

Date	Technical		Schedule		Cost		Programmatic	Overall		Events
	Project	Program	Project	Program	Project	Program	Program	Project	Program	
Jul-10	●	●	●	●	●	●	●	●	●	
Aug-10	●	●	●	●	●	●	●	●	●	TAT Report, NAS: Decadal survey release, ICRP begins
Sep-10	●	●	●	●	●	●	●	●	●	SMD's JWST budget rebaseline submission
Oct-10	●	●	●	●	●	●	●	●	●	Several technical problems resolved*
Nov-10	No Project/Program reporting									ICRP Report, Program restructuring
Dec-10	●	●	●	●	●	●	●	●	●	SMD's JWST budget rebaseline rejected
Jan-11	●	N/A	●	●	●	●	●	●	●	Replan begins
Feb-11	●	●	●	●	●	●	●	●	●	
Mar-11	●	●	●	●	●	●	●	●	●	
Apr-11	●	●	●	●	●	●	●	●	●	
May-11	●	●	●	●	●	●	●	●	●	Replan concludes, review of replan begins
Jun-11	●	●	●	●	●	●	●	●	●	
Jul-11	●	●	●	●	●	●	●	●	●	
Aug-11	●	●	●	●	●	●	●	●	●	Primary Mirror Segment production completes, TF removed from FGS
Sep-11	No Project/Program reporting									Replan approved 9/23/2011, No HQ-level monthly review
Oct-11	●	●	●	●	●	●	●	●	●	
Nov-11	●	●	●	●	●	●	●	●	●	FY2012 budget passed at replan recommended level
Dec-11	●	●	●	●	●	●	●	●	●	All mirrors completed
Jan-12	●	●	●	●	●	●	●	●	●	
Feb-12	●	●	●	●	●	●	●	●	●	
Mar-12	●	●	●	●	●	●	●	●	●	
Apr-12	●	●	●	●	●	●	●	●	●	
May-12	●	●	●	●	●	●	●	●	●	MIRI delivered, 1st flight instrument
Jun-12	●	●	●	●	●	●	●	●	●	Program office concerned with instrument schedules
Jul-12	●	●	●	●	●	●	●	●	●	
	●	Progress according to plan, all commitments can be met								
	●	Area of concern, problem can be resolved within reporting organization resources								
	●	Significant Problem, Solution not identified, Needs action/help beyond reporting organization								
	* Delivery of microshutters to ESA, NIRCcam design modifications completed, positive news on NIRSpec detectors									